THE NATION'S NEWSPAPER

Math TODAY Teacher Edition

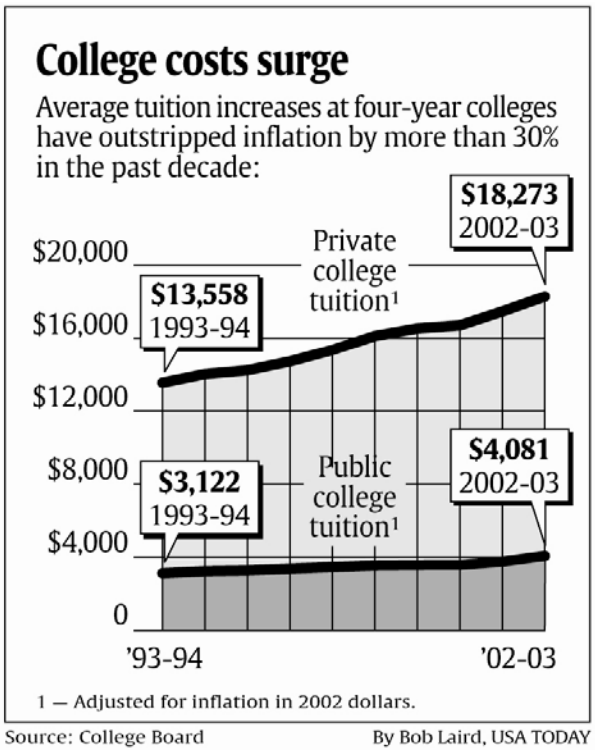
USA TODAY

NO. 1 IN THE USA

Activity 11:

College costs surge

by: Bob Tower



Activity Overview:

During this activity, students will explore the expected cost of college and also look at methods of saving money for the future. Comparing simple and compound interest will help students make decisions about their future. Students will compare two plans that address what happens over time with compound interest and what impact it makes on the total amount saved by starting early.

Concepts:

- Finding simple and compound interest
- Comparing investment plans

Activity at a Glance:

- Grade level: 9-12
- Subject: Algebra
- Estimated time: 50 minutes

Materials:

- TI-Navigator™ system
- TI-83 Plus family or TI-84 Plus family of graphing calculators
- CellSheet™ App

Recommended:

- USA TODAY Newspapers
- Multimedia Projector
- TI Keyboards

Prerequisites:

Students should know:

- the basic functionality of the CellSheet App
- about simple and compound interest
- the formulas for calculating simple and compound interest

TI navigator

For use with the TI-Navigator™ Classroom Learning System

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Student Objectives:

- Use a formula to find simple interest, given the principal, rate, and time for an investment
- Investigate the effect of two different investment plans on the total value of an investment
- Explore the future value of a given amount

Background:

Students need time and opportunity to explore the differences between simple and compound interest. This activity will give them the chance to compare the two and make observations about the future value of investments under different plans. Saving for the future isn't necessarily what students think about, so this will help make a connection to that topic.

Preparation:

- Download the activity files to your computer: Teacher Edition, Student Edition, Transparency, and LearningCheck™ Assessment. (See Appendix B for a list of the files.)
- Make copies of the Student Edition for your class. Students can refer to the Student Edition during the activity and use it to record their work.
- Set up your TI-Navigator system and make sure you are familiar with the following functions: Send to Class, Collect from Class, Screen Capture, Quick Poll, Activity Center, LearningCheck Assessment, and Class Analysis.
- Students will need a TI-83 Plus or TI-84 Plus graphing calculator, either working in pairs or individually.
- Recommendations:
  - Multimedia Projector for sharing the Activity Center, Quick Polls, and Screen Captures with your students
  - TI Keyboards to easily answer LearningCheck assessment questions

Data Source:

College Board

Activity Extensions:

- Have students graph the FV vs Simple Interest data and the FV vs Compound Interest data. Have the students write a comparison between the two scatter plots. Determine the best-fit-model for each of the scatter plots and use the models to make a prediction. Ask the students to write their observations about what is happening to the two models over a longer period of time.
- Invite a financial planning consultant from the community to talk to the class about investing for the future.
- On the last question, carry out the calculations until you reach age 65 and watch the difference grow. This is a great experience for students to talk about their future plans. Take time and have a discussion with the class about their plans.

Curriculum Connections:

- Business
- Economics
- Family and Consumer Science

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Teacher:

Students:

Classroom Management Tips:

- You may use the transparency for a class discussion before the students start working. This will give the students a better understanding of how to read the graphic and retrieve data.
- Students can work individually or in small groups on this activity.
- You may use the following formulas to calculate the entries in the activity, and depending on the ability of the class you may want to explain these before starting the activity.

  Investment 1: In B2 enter the following formula, =2000*1.09. In B3 enter, =(B2+2000)*1.09. Copy the formula in B3 through B11 to represent investing for 10 years. Starting in B12, stop the $2000 annual contribution but continue the investment, leaving the interest for the remaining years until you reach age 55.

  Investment 2: Enter the following formula, =2000*1.09 in C12, and then enter =(C12+2000)*1.09 in C13.
- This would be an activity that you could use to introduce the CellSheet application to the class. Take the time and help the students enter the formulas and copy them to complete the spreadsheet. When the students know what to do with the CellSheet App, allow them to explore the problem by changing the amount added to the investment plan annually. Change the interest rate and see what happens. This is a great problem for students to start thinking about the power of investing early.

Activity Step-by-Step:

The following steps represent a suggested TI-Navigator classroom procedure to answer the focus questions.

1. Calculator – use the data in the USA TODAY Infograph, “College costs surge” to estimate the tuition if there is a 4% increase annually in public college tuition over the next 18 years
2. Screen Capture – check student understanding
3. Calculator – based on $100, compare the difference between simple and compound interest after 10 years
4. Screen Capture – check student understanding
5. Send to Class – send the CellSheet file COLLEGE.8xv to the class

Focus Questions:

- The USA TODAY Infograph, "College costs surge" shows the average public college tuition for 2002-03 at $4,081. What is the estimated average tuition if there is a 4% annual increase over the next eighteen years?
- Based on $100, what is the difference between investments at 15% simple and compound interest after 10 years?
- How much of a difference is there between two investment plans if you start at age 20 and make regular deposits annually for ten years or

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Teacher:

6. Calculator – open the `COLLEGE` CellSheet file and complete the Investment columns for 35 years
7. Screen Capture – check student understanding
8. Calculator – export the year and investments columns into lists `YR`, `INV1`, and `INV2`, respectively
9. Calculator – create two scatter plots of Investment 1 vs. Year and Investment 2 vs. Year
10. Screen Capture – check student understanding
11. Activity Center – submit three points following the pattern of the scatter plots
12. LearningCheck Assessment – answer the focus questions and discuss the results with your class to check for understanding
13. LearningCheck Reading Comprehension – answer the reading comprehension questions and discuss the results with your class to check for understanding

See below for details on each of these steps.

Students:

you start at age 30 and make the same regular deposit until early retirement at age 55?

Reading Comprehension:

- According to "Plans to tackle college costs risk tripping up students" the average tuition and fees for public colleges increased from $3,487 to $4,694 between 2001 and 2003. What change was seen in private college tuition and fees during this period?
- The increases have prompted students and parents to voice their concern and gain the attention of Republicans and Democrats in Congress. What are the solutions proposed by Democrats and Republicans?
- The article states that the tuition at four-year public colleges rose by 202% during the past 22 years. What was the increase in the consumer price index during this period? If the trend continues, what will be the expected tuition and fees at public four-year colleges and private colleges by 2010?
- The maximum value of the Pell Grants awarded to poor students has risen 1% during the past three years. What percent of the total cost does the average Pell Grant cover at public four-year colleges?
- What does the article say the federal government can do to help make parents better shoppers and state legislators better managers of state colleges?
- What were the reasons given that poor students/families didn't receive help with costs when Congress passed the higher education tax credits in 1997?

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Teacher: **Students:**

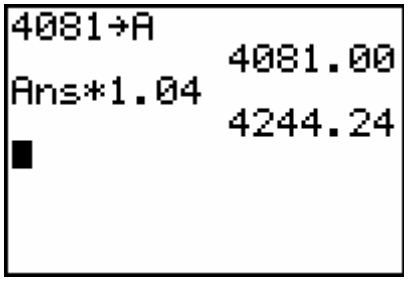
STEP 1 – CALCULATOR

1. Instruct students to use the data in the USA TODAY Infograph "College costs surge" to estimate the average tuition to a public college if there is a 4% increase annually in tuition over the next 18 years.

   The image at the right shows the start to the home screen calculations. The number 4244.24 represents the total value of 4081 after one year with a 4% increase.

2. Instruct students to complete their calculations on the home screen for 18 years.

1. Use the home screen to make your calculations.



2. Press [ENTER] until you have completed the calculations for the 18 year period.

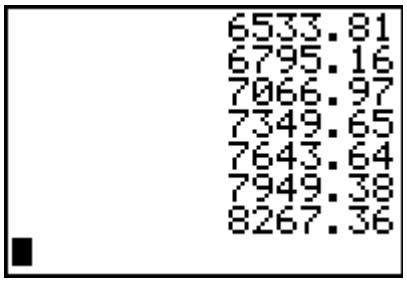
STEP 2 – SCREEN CAPTURE

1. Use **Screen Capture** to check student understanding.

   The image at the right shows the average tuition estimate after eighteen years.

2. Ask students to interpret the values.

   For example, What does the number 7643.64 mean in the context of this problem situation?



STEP 3 – CALCULATOR

1. Based on a $100 investment and 15% interest rate, instruct your students to compare the difference between the future value of simple and compound interest after 10 years.

1. Press [2nd] [QUIT] to return to the home screen.
2. Repeat the procedure in Step 1 for each of the investments and record your final answer on the Student Edition for later use.

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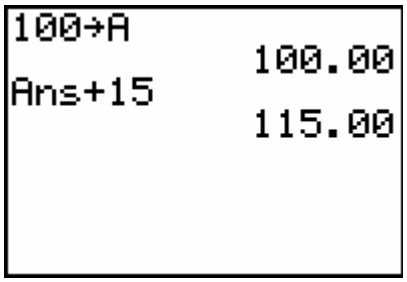
Teacher: **Students:**

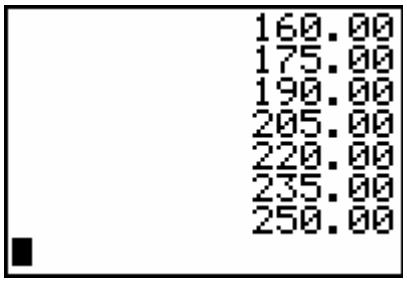
STEP 4 – SCREEN CAPTURE

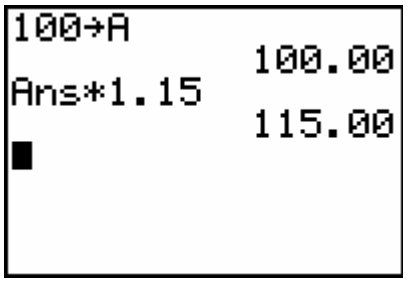
1. Use **Screen Capture** to check student understanding.

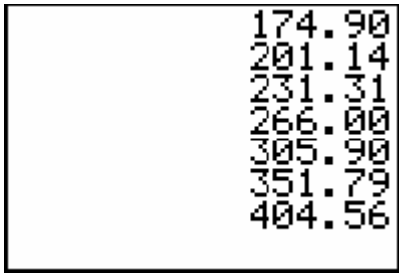
   The first two images at the right represent the future value of the $100 investment after 10 years using simple interest. The next two images represent the future value of the $100 investment using compound interest.

2. Instruct your students to find the difference between the two investments on the home screen of their calculator.









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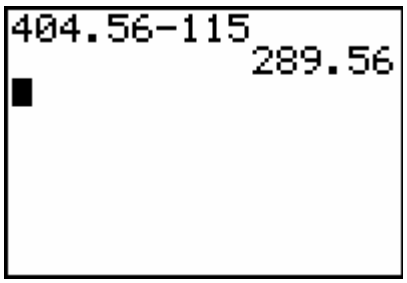
Teacher:	Students:
3. **Use Screen Capture** to check for understanding. *The screen image shows the difference between the two investments.* 4. Ask students to explain what 289.56 means. ***Note**: Remind students to use the appropriate labels/units.*	
5. Instruct your students to login to TI-Navigator when you are ready to go to the next step.	1. Press PRGM, select GONAVNET and press ENTER.
STEP 5 – SEND TO CLASS 1. After students have logged into TI-Navigator, send the CellSheet™ App file COLLEGE.8xv to the class using **Force send to students now**. *The CellSheet file includes three columns: Year, Investment 1, Investment 2.* *Investment 1 shows the parent beginning to save at age 20 with regular deposits annually for 10 years, and then stopping the annual contribution but allowing the investment to gain interest for the next 25 years.* *Investment 2 shows the parent beginning to save at age 30 with regular deposits annually for 25 years.* 2. Instruct your students to exit the TI-Navigator system when you are ready to go to the next step.	1. Wait for the teacher transfer – the data is downloaded into the CellSheet App. 2. Once the file is downloaded, press BACK (ZOOM) and then 4 to EXIT APP.
STEP 6 – CALCULATOR 1. Instruct your students to open the COLLEGE Cellsheet file and use the functionality of a spreadsheet to complete the Investment columns for 35 years. The spreadsheet is formatted with all formulas and the students need to copy the formulas to complete the spreadsheet. 2. Remind students that the formula for INV1 changes from year 11 through 35, and that INV2 starts in year 11.	1. Press APPS and select Celsheet. 2. Press MENU (GRAPH) File… and Open… . 3. Select COLLEGE and press ENTER. 4. Highlight cell A3 and press ZOOM to copy the formula. 5. Press Range (Y=) and use the ▼ to highlight the column through cell A36. 6. Press Paste (TRACE) to complete the copy feature. 7. Repeat 4-6 to complete columns B and C.

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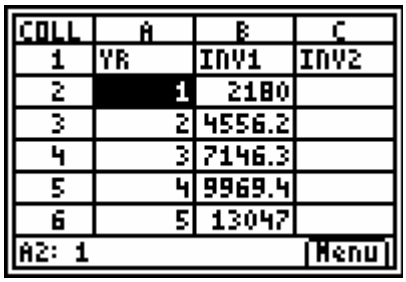
Teacher: **Students:**

STEP 7 – SCREEN CAPTURE

1. Use **Screen Capture** to check student understanding.

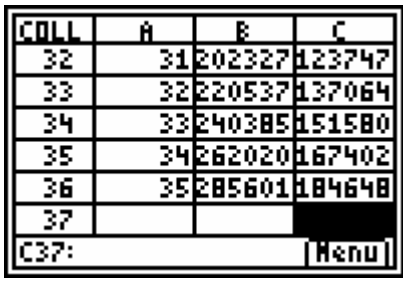
   The spreadsheet, `COLLEGE`*, should look like the first image on the right. If not, this is an opportunity to discuss how to create a spreadsheet using the CellSheet App.*

   The second image on the right represents the final values of both investments. This is an opportunity to discuss how to create a spreadsheet and check student understanding.



COLL	A	B	C
1	YR	INV1	INV2
2	1	2180	
3	2	4556.2	
4	3	7146.3	
5	4	9969.4	
6	5	13047	

A2: 1 [Menu]



COLL	A	B	C
32	31	202327	123747
33	32	220537	137064
34	33	240385	151580
35	34	262020	167402
36	35	285601	184648
37			

C37: [Menu]

STEP 8 – CALCULATOR

1. Instruct your students to export the year and investments columns into lists named `YR`, `INV1`, and `INV2`, respectively.

   See the CellSheet App User's Guide on the CD for information on exporting CellSheet columns to calculator lists.

1. Press `MENU` (GRAPH) `Options...`
2. Select `4:Import/Export...` and press ENTER.
3. Choose `2:Export List...` and enter the range of cells to export to the calculator.
   - `A2:A36` named `YR`
   - `B2:B36` named `INV1`
   - `C11:C36` named `INV2`
4. Enter the list names (listed above) and press ENTER ENTER.
5. Repeat 1-4 for the remaining columns.

STEP 9 – CALCULATOR

1. Instruct your students to create two scatter plots of `INV1` vs. `YR` and `INV2` vs. `YR2`.
2. Instruct students to create a new list representing the years during the second investment.

1. Press 2nd [LIST] to find the list names that were exported.
2. Press STAT ENTER to create a new

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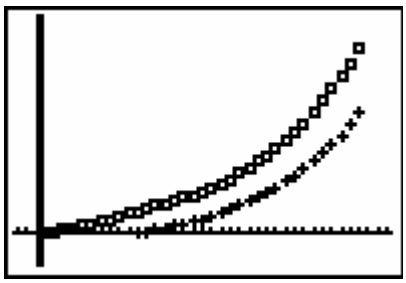
Teacher:	Students:
	list named YR2 that will represent the years for Investment 2. 3. Press 2nd [STAT PLOT] and set up both scatter plots (INV1 vs YR and INV2 vs YR2). 4. Press ZOOM and select 9:ZoomStat to display the graphs of both scatter plots.
STEP 10 – SCREEN CAPTURE 1. Use **Screen Capture** to check student understanding. *The graph should look like the image on the right. If not, this is an opportunity to discuss how to create scatter plots.* 2. Instruct your students to return to TI-Navigator when you are ready to go to the next step.	 1. Press PRGM, select GONAVNET and press ENTER.
STEP 11 – ACTIVITY CENTER 1. In Activity Center, use **Load Activity Settings** to load MT_College1.act. 2. Press **Start Activity** to begin. 3. Instruct your students to submit three points following the pattern of the scatter plot for Investment 1. 4. Divide the class into groups and assign different three-year intervals to use, such as: • Group 1 – years 36-38 • Group 2 – years 39-41 and so on Number of groups and group size is dependent on your class. 5. As submissions appear, discuss the following with your class to check for understanding: • Submissions that are particularly interesting or ambitious • Submissions that have common errors	1. From the TI-Navigator home screen press 1 Activity Center. 2. When prompted, enter the group ordered pairs showing the expected growth of Investment 1. OPTION: Press PLOT (@) to view the graph of the points before sending. 3. Press SEND to submit the points to the Activity Center.

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Teacher:

NOTE: Select **Pause Activity** to have a class discussion. Select **Resume Activity** to continue.

Sample discussion questions:

- *What would happen to the investment if the interest rate was increased?*
- *Explain the impact on the investment if the beginning amount was increased.*

6. Press **Stop Activity** when you are ready to continue.
7. In Activity Center, use **Load Activity Settings** to load MT_College2.act.
8. Press **Start Activity** to begin.
9. Instruct your students to submit three points following the pattern of the scatter plot for Investment 2.
10. Use the same groups and three-year intervals that were assigned in #4.
11. As submissions appear, discuss the following with your class to check for understanding:
    - Submissions that are particularly interesting or ambitious
    - Submissions that have common errors

    NOTE: Select **Pause Activity** to have a class discussion. Select **Resume Activity** to continue.

    Sample discussion questions:

    - *What would happen to the investment if the interest rate was increased?*
    - *Explain the impact on the investment if the beginning amount was increased.*
12. Press **Stop Activity** when you are ready to go to the next step.

Students:

4. When prompted, enter the group ordered pairs showing the expected growth of Investment 2.

   OPTION: Press PLOT (@) to view the graph of the points before sending.

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Teacher: **Students:**

STEP 12 – LEARNINGCHECK ASSESSMENT

1. Using **Send to Class**, distribute the LearningCheck assessment file College1.edc to your students using **Force send to students now**.
2. Prompt them to open the LearningCheck assignment and answer the following questions:

   Q. The USA TODAY Infograph, "College costs surge" shows the average private college tuition for 2002-03 at $18,273. What is the estimated average tuition if there is a 4% annual increase over the next 18 years?

   A. The estimated amount for the average tuition is $37,018 (rounded to the nearest dollar).

   Q. Based on $1,000, what is the difference between investments at 12% simple and compound interest after 10 years?

   A. After 10 years, simple interest is $2,200, compound interest is $3,106 (rounded to nearest dollar). The difference is $906.

   Q. How much of a difference is there between two investment plans if you start at age 20 and make regular deposits annually for ten years or you start at age 30 and make the same regular deposit until early retirement at age 55?

   A. The first investment will have $100,953 more than the other plan, but will have had fewer contributed total dollars.
3. Select **Class Analysis** and make sure all of the students have completed the assignment.
4. Select **Collect Answers Files From Class**.

   NOTE: Before collecting the answers, we recommend that you check these options:
   - **Delete Answer File from Device after Collect**
   - **Delete Assignment File from Device after Collect**
5. Using **Class Results Slide Show**, discuss the results with your class to check for understanding.

1. Press [2nd] [QUIT] to return to the TI-Navigator home screen.
2. From the TI-Navigator home screen press [2] `Network Apps`.
3. Select `LearnChk`.
4. Select the `COLLEGE` assignment and follow the prompts to answer the questions.

NOTE: *TI Keyboards may be used.*

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Teacher: **Students:**

STEP 13 – LEARNINGCHECK READING COMPREHENSION

1. Instruct students to return to the TI-Navigator home screen.
2. Using **Send to Class**, distribute the LearningCheck assessment file College2.edc to your students using **Force send to students now**.
3. Prompt them to open the LearningCheck assignment and answer the following questions regarding the USA TODAY articles.

Q. According to "Plans to tackle college costs risk tripping up students" the average tuition and fees for public colleges increased from $3,487 to $4,694 between 2001 and 2003. What change was seen in private college tuition and fees during this period?

A. Private college tuition and fees increased from $16,233 to $19,710 during this same time period.

Q. The increases have prompted students and parents to voice their concern and gain the attention of Republicans and Democrats in Congress. What are the solutions proposed by Democrats and Republicans?

A. Democrats want to penalize state legislatures that slacken their support.

Republicans are pushing a plan to penalize public and private colleges if their tuition increases outpace inflation.

Q. The article states that the tuition at four-year public colleges rose by 202% during the past 22 years. What was the increase in the consumer price index during this period? If the trend continues, what will be the expected tuition and fees at public four-year colleges and private colleges by 2010?

A. The consumer price index increased by 80% during this same time period. The tuition and fees by 2010 for public four-year colleges is expected to be $7,082 and $28,182 for private colleges.

Q. The maximum value of the Pell Grants awarded to poor students has risen 1% during the past three years. What percent of the total cost does the average Pell Grant cover at public four-year colleges?

A. The average Pell Grant covers less than 30% of total cost according to the College Board.

1. Press [2nd] [QUIT] to return to the TI-Navigator home screen.
2. From the TI-Navigator home screen press [2] `Network Apps`.
3. Select `LearnChk`.
4. Select the `COLLEGE2` assignment and follow the prompts to answer the questions.

***NOTE**: It is recommended that students use TI Keyboards to answer reading comprehension questions. If you don't have TI Keyboards, these questions are in the Student Edition and can be answered in writing.*

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Teacher:

Students:

Q. What does the article say the federal government can do to help make parents better shoppers and state legislators better managers of state colleges?

A. The federal government could release the average price change for each college over the past decade. Including scores on graduate school exams, job placement rates, and how many students graduate in four years would help parents and students.

Q. What were the reasons given that poor students/families didn't receive help with costs when Congress passed the higher education tax credits in 1997?

A. Disadvantaged families can't get refundable tax credits for tuition, and disadvantaged students can't use the credits to purchase textbooks. The College Board stated that this means college costs eat up 71% of earnings for low-income families, but only 6% for the top 25% of earners.

4. Select **Class Analysis** and make sure all of the students have completed the assignment.
5. Select **Collect From Class**.

   NOTE: Before collecting the answers, we recommend that you check these options:

   - **Delete Answer File from Device after Collect**
   - **Delete Assignment File from Device after Collect**
6. Using **Class Results Slide Show**, discuss the results with your class to check for understanding.

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